EXEMPLAR
SOLUTIONS
PHYSICS

Class
11

Multiple Choice Questions I

5.1. A ball is travelling with uniform translator motion. This means that
a) it is at rest
b) the path can be a straight line or circular and the ball travels with uniform speed
c) all parts of the ball have the same velocity and the velocity is constant
d) the centre of the ball moves with constant velocity and the ball spins about its centre
uniformly Answer:
The correct option is c) all parts of the ball have the same velocity and the velocity is constant

5.2. A metre scale is moving with uniform velocity. This implied
a) the force acting on the scale is zero, but a torque about the centre of mass can act on the scale
b) the force acting on the scale is zero and the torque acting about the centre of mass of the scale is also zero
c) the total force acting on it need not be zero but the torque on it is zero
d) neither the force nor the torque need to be zero Answer:
The correct answer is b) the force acting on the scale is zero and the torque acting about the centre of mass of the scale is also zero

5.3. A cricket ball of mass 150 g has an initial velocity $u = (3\hat{i} + 4\hat{j})$ **m/s and a final velocity** $v = -(3\hat{i} + 4\hat{j})$ **m/s after being hit. The change in momentum**

a) zero
b) $-(0.45\hat{i} + 0.6\hat{j})$
c) $-(0.9\hat{i} + 1.2\hat{j})$
d) $-5(\hat{i} + \hat{j})$

Answer:
The correct answer is c) $-(0.9\hat{i} + 1.2\hat{j})$

5.4. In the previous problem, the magnitude of the momentum transferred during the hit is
a) zero
b) 0.75 kg.m/s
c) 1.5 kg.m/s
d) 14 kg.m/s
Answer:
The correct option is c) 1.5 kg.m/s

5.5. Conservation of momentum in a collision between particles can be understood from
a) conservation of energy
b) Newton's first law only
c) Newton's second law only
d) both Newton's second and third law
Answer:
The correct answer is d) both Newton's second and third law

5.6. A hockey player is moving northward and suddenly turns westward with the same speed to avoid an opponent. The force that acts on the player is
a) frictional force along westward
b) muscle force along southward
c) frictional force along south-west
d) muscle force along south-west
Answer:
The correct answer is c) frictional force along south-west

5.7. A body of mass 2 kg travels according to the law $x(t) = p(t) + qt2 + rt3$ where p = 3 m/s, q = 4 m/s2, and r = 5 m/s3. The force acting on the body at t=2 seconds is
a) 136 N
b) 134 N
c) 158 N
d) 68 N
Answer:
The correct answer is a) 136 N

$$F = (-3\hat{i} + 4\hat{j})$$

5.8. A body with mass 5 kg is acted upon by a force N. If its initial velocity at t =

0 is $v = (6\hat{i} - 12\hat{j})$ **m/s, the time at which it will just have a velocity along the y-axis is**
a) never
b) 10 s
c) 2 s
d) 15 s
Answer:
The correct answer is b) 10 s

5.9. A car of mass m starts from rest and acquires a velocity along east $v = v\hat{i}$ **in two seconds. Assuming the car moves with uniform acceleration, the force exerted on the car is**
a) mv/2 eastward and is exerted by the car engine
b) mv/2 eastward and is due to the friction on the tyres exerted by the road
c) more than mv/2 eastward exerted due to the engine and overcomes the friction of the road
d) mv/2 exerted by the engine
Answer:
The correct answer is b) mv/2 eastward and is due to the friction on the tyres exerted by the road

Multiple Choice Questions II

5.10. The motion of a particle of mass m is given by x = 0 for t < 0 sec, x(t) = A sin 4p t for 0 < t < (1/4) sec,

and x = 0 for t > (1/4) sec. Which of the following statements is true?

a) the force at t = (1/8) sec on the particle is -16π2Am

b) the particle is acted upon by on impulse of magnitude 4π2Am at t = 0 sec and t = (1/4) sec

c) the particle is not acted upon by any force

d) the particle is not acted upon by a constant force

e) there is no impulse acting on the particle

Answer:

The correct answer is:

a) the force at t = (1/8) sec on the particle is -16π2Am

b) the particle is acted upon by on impulse of magnitude 4π2Am at t = 0 sec and t = (1/4) sec

d) the particle is not acted upon by a constant force

5.11. In figure, the coefficient of friction between the floor and the body B is 0.1. The coefficient of friction between the bodies B and A is 0.2. A force F is applied as shown on B. The mass of A is m/2 and of B is m. Which of the following statements are true?
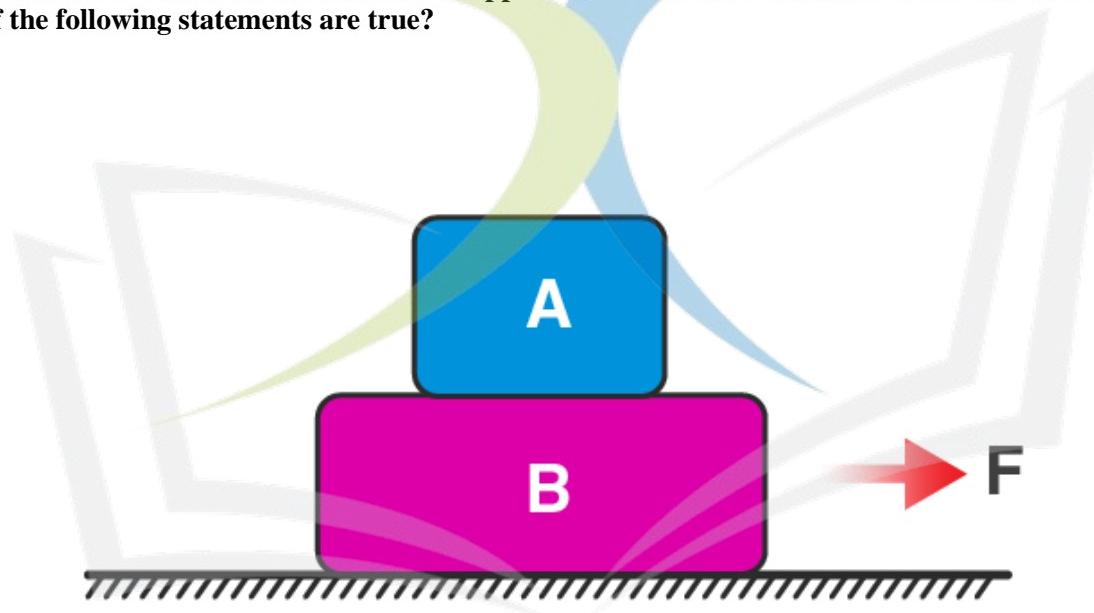
a) the bodies will move together if F = 0.25 mg

b) the body A will slip with respect to B if F = 0.5 mg

c) the bodies will move together if F = 0.5 mg

d) the bodies will be at rest if F = 0.1 mg

e) the maximum value of F for which the two bodies will move together is 0.45 mg

Answer:

The correct answer is:

a) the bodies will move together if F = 0.25 mg

b) the body A will slip with respect to B if F = 0.5 mg

d) the bodies will be at rest if F = 0.1 mg

e) the maximum value of F for which the two bodies will move together is 0.45 mg

5.12. Mass m_1 moves on a slope making an angle θ with the horizontal and is attached to mass m_2 by a

string passing over a frictionless pulley as shown in the figure. The coefficient of friction between m1 and the sloping surface is μ. Which of the following statements are true?
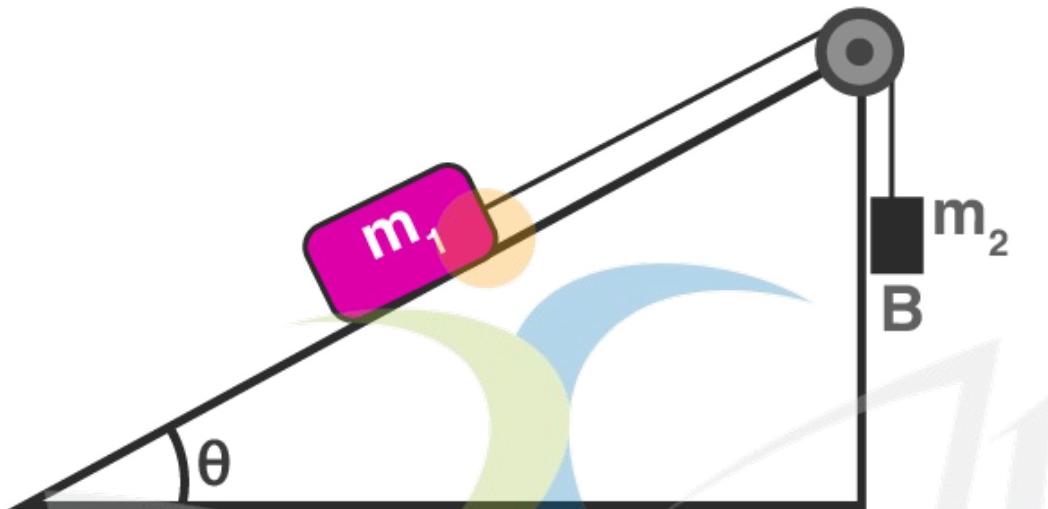
a) if $m_2 > m_1 \sin \theta$, the body will move up the plane
b) if $m_2 > m_1(\sin \theta + \mu \cos \theta)$, the body will move up the plane
c) if $m_2 < m_1 (\sin \theta + \mu \cos \theta)$, the body will move up the plane
d) if $m_2 < m_1 (\sin \theta - \mu \cos \theta)$, the body will move down the plane
Answer:

The correct answer is:
b) if $m_2 > m_1(\sin \theta + \mu \cos \theta)$, the body will move up the plane
d) if $m_2 < m_1 (\sin \theta - \mu \cos \theta)$, the body will move down the plane

5.13. In the figure, a body A of mass m slides on plane inclined at angle θ_1 to the horizontal and μ1 is the coefficient of friction between A and the plane. A is connected by a light string passing over a frictionless pulley to another body B, also of mass m, sliding on a frictionless plane inclined at angle θ_2 to the horizontal. Which of the following statements are true?

NAGEEN GROUP

tamso ma jyotirgamaya
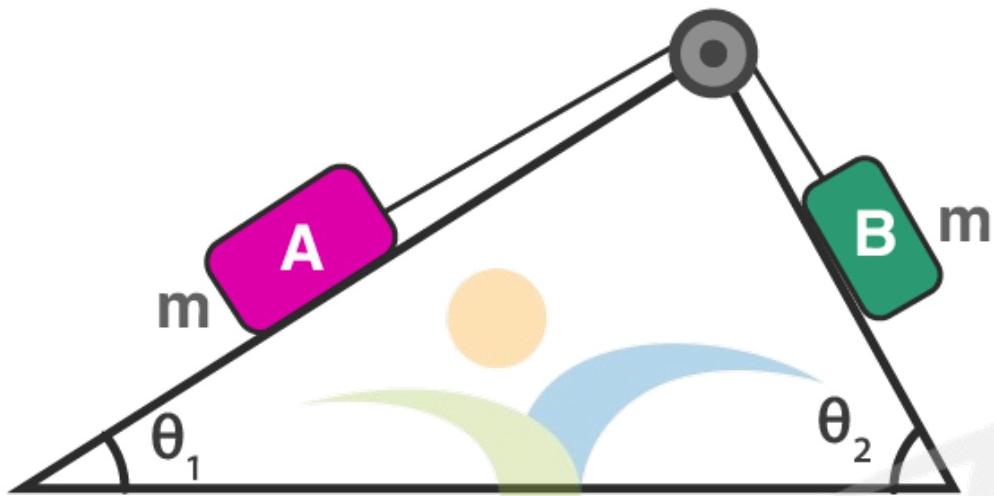
a) A will never move up the plane

$$\mu = \frac{sin\theta_2 - sin\theta_1}{cos\theta_1}$$

b) A will just start moving up the plane when
c) for A to move up the plane, θ_2 must always be greater than θ_1
d) B will always slide down with constant speed
Answer:
The correct answer is:

$$\mu = \frac{sin\theta_2 - sin\theta_1}{cos\theta_1}$$

b) A will just start moving up the plane when
c) for A to move up the plane, θ_2 must always be greater than θ_1

5.14. Two billiard balls A and B, each of mass 50 g and moving in opposite directions with speed of 5 m/s each, collide and rebound with the same speed. If the collision lasts for 10^{-3} seconds, which of the following statements are true?
a) the impulse imparted to each ball is 0.25 kg.m/s and the force on each ball is 250N
b) the impulse imparted to each ball is 0.25 kg.m/s and the force exerted on each ball is 25×10^{-5} N
c) the impulse imparted to each ball is 0.5 Ns
d) the impulse and the force on each ball are equal in magnitude and opposite in direction
Answer:
The correct answer is:
c) the impulse imparted to each ball is 0.5 Ns
d) the impulse and the force on each ball are equal in magnitude and opposite in direction

5.15. A body of mass 10 kg is acted upon by two perpendicular forces, 6N and 8N. The resultant acceleration of the body is
a) 1 m/s^2 at an angle of tan^{-1} (4/3) w.r.t 6N force

b) 0.2 m/s² at an angle of tan⁻¹ (4/3) w.r.t 6N force
c) 1 m/s² at an angle of tan⁻¹(3/4) w.r.t 8N force
d) 0.2 m/s² at an angle of tan⁻¹(3/4) w.r.t 8N force
Answer:
a) 1 m/s^2 at an angle of $\tan^{-1} (4/3)$ w.r.t 6N force
c) 1 m/s^2 at an angle of $\tan^{-1}(3/4)$ w.r.t 8N force

Very Short Answer

5.16. A girl riding a bicycle along a straight road with a speed of 5 m/s throws a stone of mass 0.5 kg which has a speed of 15 m/s with respect to the ground along her direction of motion. The mass of the girl and the bicycle is 50 kg. Does the speed of the bicycle change after the stone is thrown? What is the change in speed, if so?
Answer:
Given,
$m_1 = 50$ kg
$m_2 = 0.5$ kg
$u_1 = 5$ m/s
$u_2 = 5$ m/s
$v_1 = ?$
$v_2 = 15$ m/s
From the law of conservation of momentum,
Initial momentum = final momentum
$(m_1 + m_2) u_1 = m_1 v_1 + m_2 v_2$
Substituting the values, we get
$v_1 = 4.9$ m/s
Therefore, the speed of cycle and the girl decreases by: $5 - 4.9 = 0.1$ m/s.

5.17. A person of mass 50 kg stands on a weighing scale on a lift. If the lift is descending with a downward acceleration of 9 m/s2 what would be the reading of the weighing scale?
Answer:
The apparent weight on the weighing scale decreases when the lift descends with an acceleration a.
Let W' be the apparent weight
Therefore,
$W' = R = (mg - ma) = m(g - a)$
Therefore, apparent weight, $W' = 50(10-9) = 50$ N
Reading of the weighing scale = $R/g = 50/10 = 5$ kg.

5.18. The position time graph of a body of mass 2 kg is as given in the figure. What is the impulse on the body at t – 0 sec and t = 4 sec.
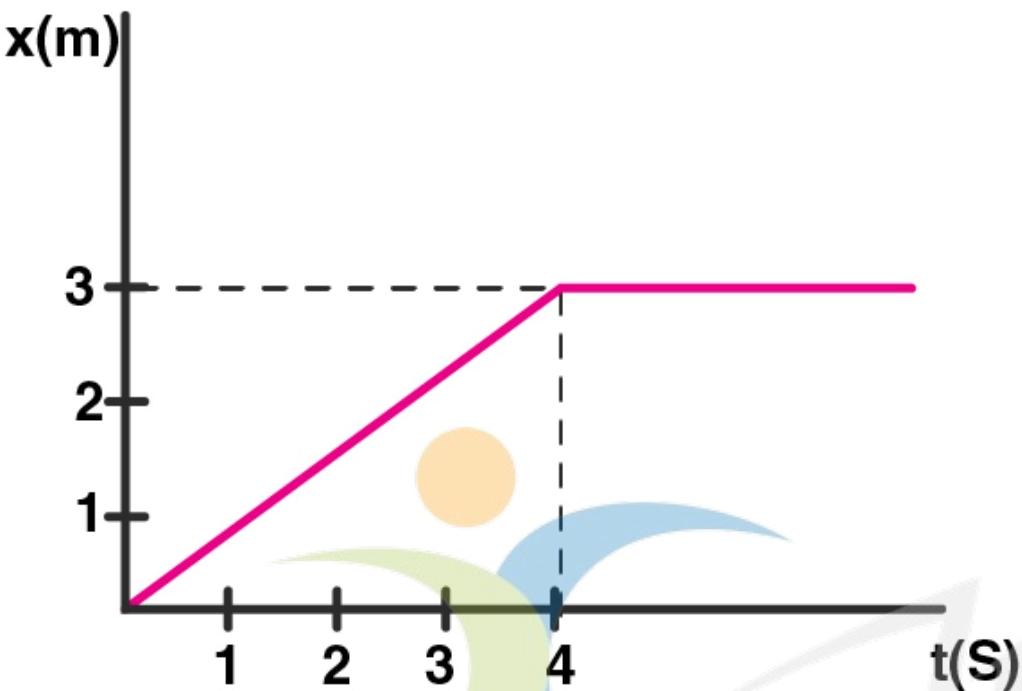
Answer:
Mass of body, m = 2 kg
Time, t = 0
Initial velocity, v1 = 0
From graph, we know that
t ≥ 0 to t ≤ 4 which is a straight line.
The velocity of the body is constant
v2 = tan θ = 3/4 = 0.75 m/s
At t ≥ 4, the slope of the graph is zero so velocity v3 = 0
Impulse = **F**t = (d**p**/dt)dt = d**p**
Impulse = change in momentum
Impulse at t = 0 is given as:
2(0.75 − 0) = 1.50 kg.m/s
Impulse at t = 4 is given as:
m(v3 − v2) = 2(0-0.75) = -1.50 kg.m/s
Therefore, impulse at t = 0 increases by +1.5 kg.m/s and at t = 4 it decreases by -1.5 kg.m/s.

5.19. A person driving a car suddenly applies the brakes on seeing a child on the road ahead. If he is not wearing seat belt, he falls forward and hits his head against the steering wheel. Why?
Answer:
When a person applies brakes suddenly, he tends to fall forward and hit his head against the steering wheel if he is not wearing the seat belt because his upper body continues to be in a state of motion and in the same direction as that of the car which is due to inertia of motion.

5.20. The velocity of a body of mass 2 kg as a function of t is given by $v(t) = 2t\hat{i} + t^2\hat{j}$ **Find the**

momentum and the force acting on it at time t = 2 sec.
Answer:
m = 2 kg

$$\overrightarrow{v}(t) = 2t\hat{i} + t^2\hat{j}$$

$$\overrightarrow{v} \; at \; 2 \; sec, \overrightarrow{v}(2t) = 2(2t)\hat{i}2^2\hat{j}, v(2) = 4\hat{i} + 4\hat{j}$$

$$Momentum, \overrightarrow{P}(2) = m \overrightarrow{v}(2)$$

$$\overrightarrow{P}(2) = 2[4\hat{i} + 4\hat{j}], p(2) = 8\hat{i} + 8\hat{j} \; kg.m/s$$

$$\overrightarrow{F} = m \overrightarrow{a}$$

$$\overrightarrow{v}(t) = 2t\hat{i} + t^2\hat{j}$$

$$\overrightarrow{a}(t) = \frac{d\overrightarrow{v}(t)}{dt} = 2\hat{i} + 2t\hat{j}$$

$$\overrightarrow{F}(2) = 2(2\hat{i} + 4\hat{j}) = 4\hat{i} + 8\hat{j}N$$

5.21. A block placed on a rough horizontal surface is pulled by a horizontal force F. Let f be the force applied by the rough surface on the block. Plot a graph of f versus F.
Answer:
F1 is the force that is acting on the heavy box which is opposed by the smaller frictional force f1 and is equal to F1. For box to move, F = Fs which is the maximum static frictional force. This force is also corresponding to the frictional force fs on the y-axis.

The frictional force decreases when Fk < Fs is applied on the body and it starts to move such the less friction is fk < fs.
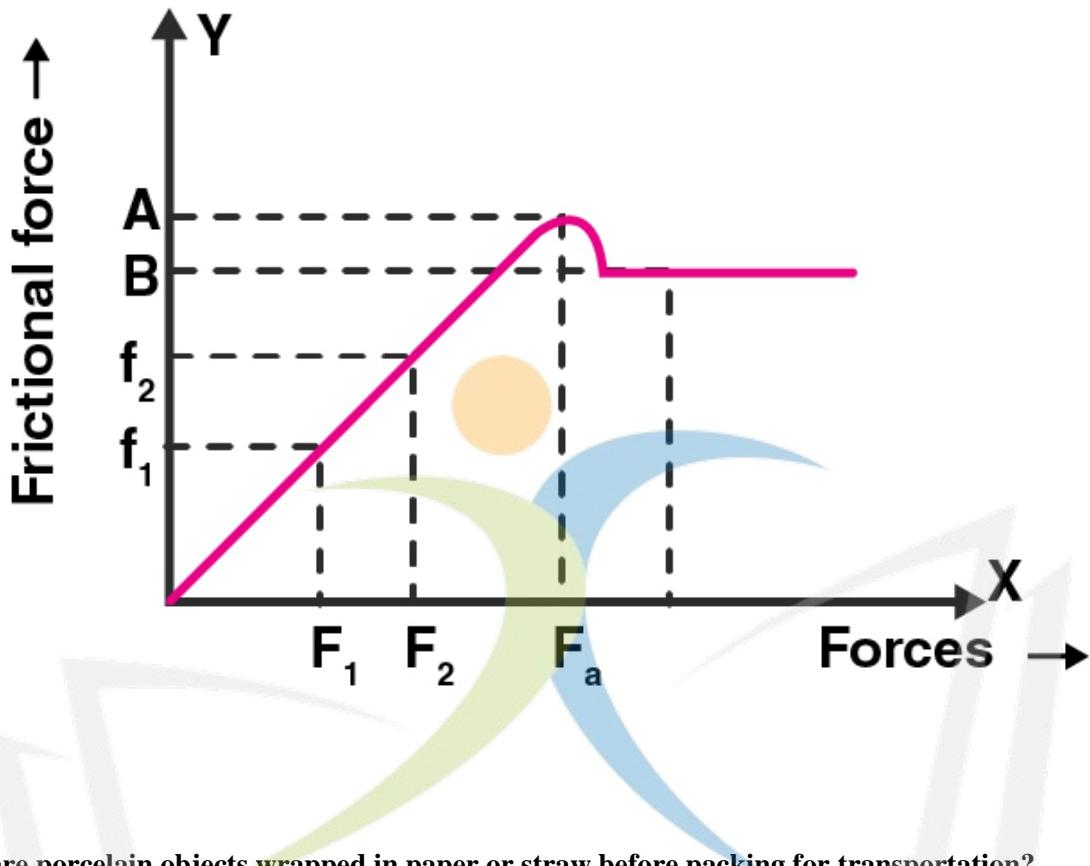
5.22. Why are porcelain objects wrapped in paper or straw before packing for transportation?
Answer:
Porcelain objects are wrapped in paper or straw before packing for transportation because they fragile in nature. While transporting these objects change in velocity might bring cracks on them when the acceleration (v – u)/t decreases. To avoid the force on these objects, they are wrapped with paper.

5.23. Why does a child feel more pain when falls down on a hard cement floor, than when she falls on the soft muddy ground in the garden?
Answer:
When a child falls on a hard cement floor, the child feels more pain than when the child falls on the soft muddy ground in the garden because the time taken by the child to stop is very small on the cemented ground whereas on the soft muddy ground, the time taken is more. When the time taken to stop is more, the acceleration is decreased resulting in reduced force.

5.24. A woman throws an object of mass 500 g with a speed of 25 m/s.
a) what is the impulse imparted to the object?
b) if the object hits a wall and rebounds with half the original speed, what is the change in momentum of the object?
Answer:
a) Mass of the object, m = 500 g = 0.5 kg
u = 0
v = 25 m/s
Impulse is given as:

$$\overrightarrow{F} \cdot dt = \frac{d\overrightarrow{p}}{dt} \cdot dt = d\overrightarrow{p} = m\overrightarrow{v} - m\overrightarrow{u}$$

Substituting the values, we get impulse = 12.5 N.s

b) m = 0.5 kg
u = +25 m/s
v = -25/2 m/s
Δp = m(v − u) = -18.75 N.s

**5.25. Why are mountain roads generally made winding upwards rather than going straight up?**
Answer:
The mountain roads are generally made winding upwards rather than going straight up because the force of friction is high which reduces the chances of skidding. When the roads are straight up, the value of frictional force increases which increases the chance of skidding. This is given by:
fs = μN cosθ where θ is the angle of inclination.

Short Answers

5.26. A mass of 2 kg is suspended with thread AB. Thread CD of the same type is attached to the other end of 2 kg mass. Lower thread is pulled gradually harder and harder in the downward direction so as to apply force on AB. Which of the threads will break and why?
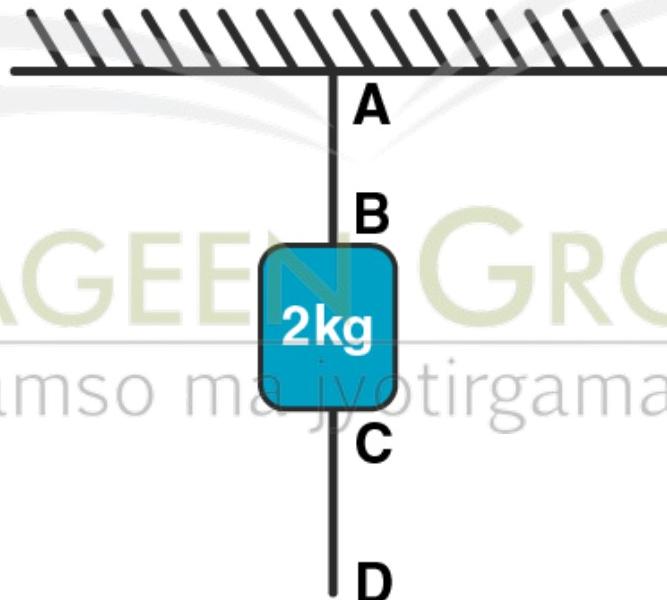
Answer:
The force acting on the thread AB is equal to the force F as the mass 2 kg is acting downward. So, it can be said that the force acting on the AB is 2 kg more than on D and therefore, the thread AB breaks.

5.27. In the above given problem if the lower thread is pulled with a jerk, what happens?
Answer:
When the lower thread is pulled with a jerk, the thread CD breaks the thread is under inertia of rest and the mass 2 kg above acts on it.

5.28. Two masses of 5 kg and 3 kg are suspended with help of massless inextensible strings as shown in the figure. Calculate T_1 and T_2 when whole system is going upwards with acceleration = 2 m/s².
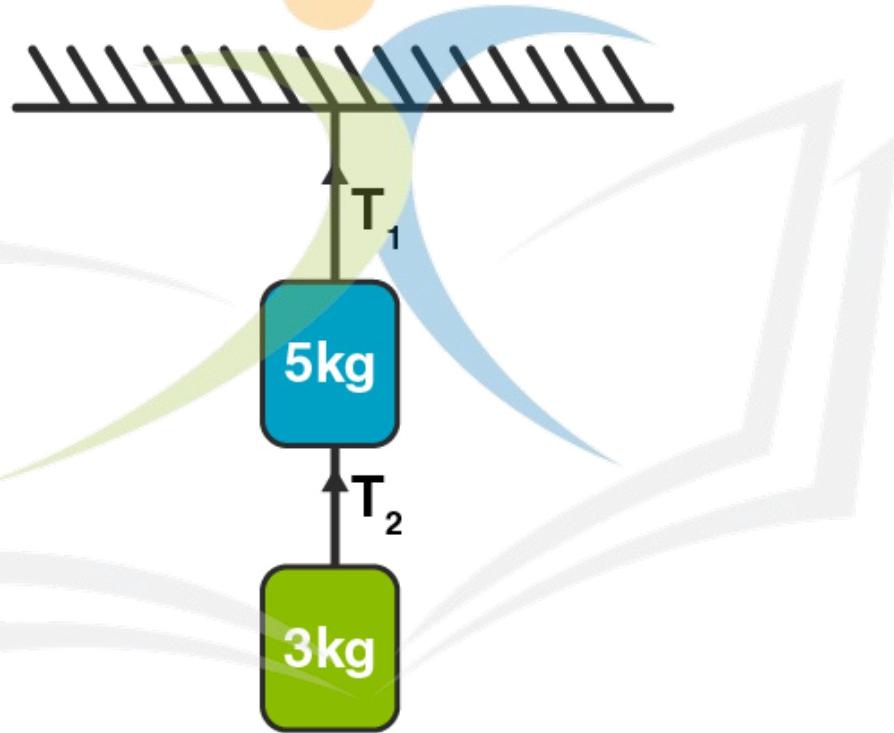
Answer:
The acceleration of the whole system is, a = 2 m/s2
m1 = 5 kg
m2 = 3 kg
g = 9.8 m/s2
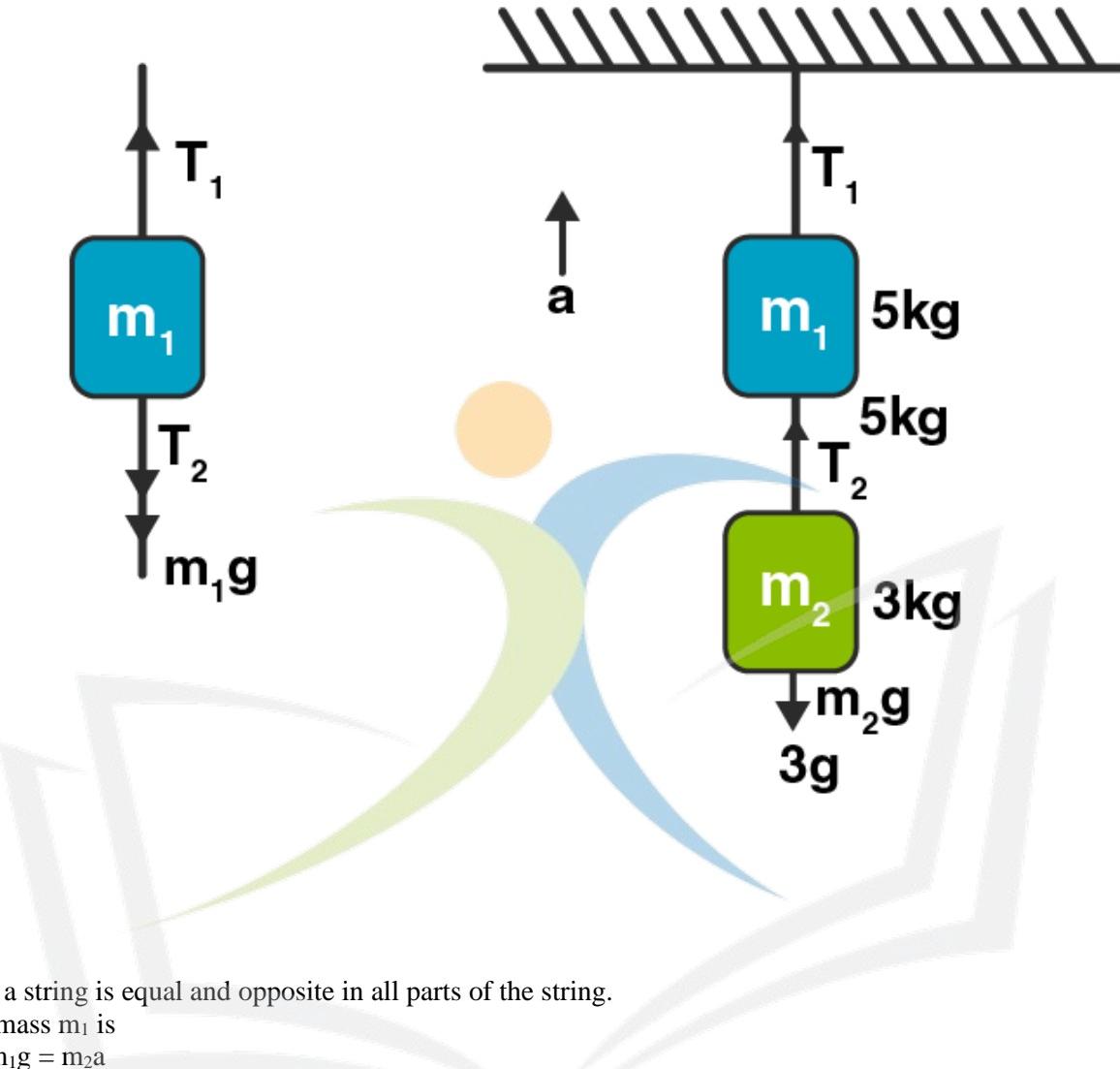
Tension in a string is equal and opposite in all parts of the string.

Forces on mass m_1 is

$T_1 - T_2 - m_1g = m_2a$

$T_1 - T_2 - 5g = 5a$

$T_1 - T_2 = 5g + 5a$

$T_1 - T_2 = 5(9.8 + 2)$

$T_1 - T_2 = 59$ N

Force on mass m_2 is

$T_2 - m_2g = m_2a$

$T_2 = m_2(g + a) = 3 (9.8 + 2) = 35.4$

$T_1 = 94.4$ N

5.29. Block A of weight 100N rests on a frictionless inclined plane of slope angle 30º. A flexible cord attached to A passes over a frictionless pulley and is connected to block B of weight W. Find the weight W for which the system is in equilibrium.
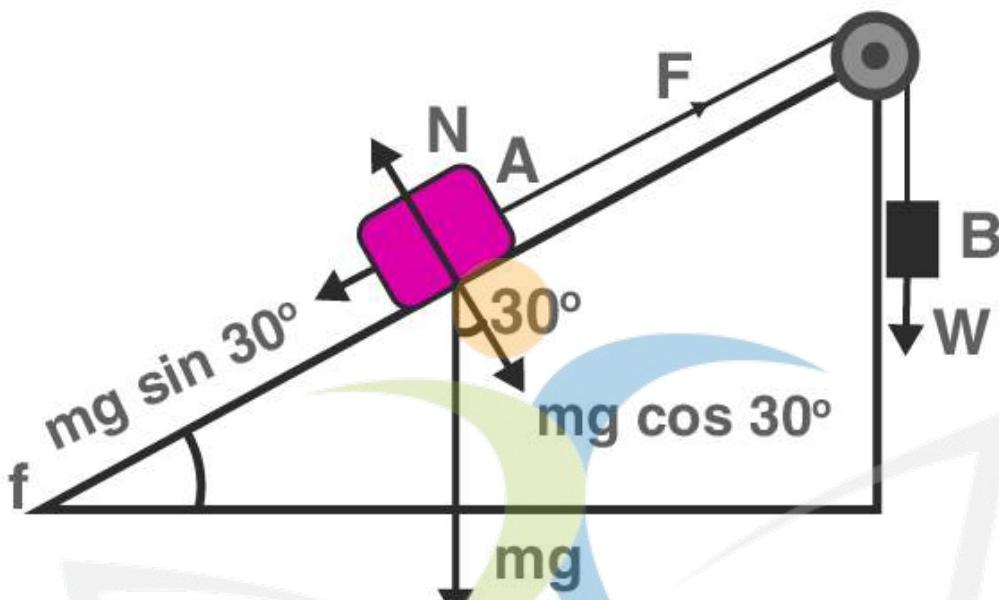
Answer:
When there is equilibrium between A or B,
mg sin 30° = F
1/2 mg = F
F = (1/2)(100) = 50
Therefore, when B is at rest, W = F = 50 N.

5.30. A bock of mass M is held against a rough vertical wall by pressing it with a finger. If the coefficient of friction between the block and the wall is μ and the acceleration due to gravity is g, calculate the minimum force required to be applied by the ginger to hold the block against the wall?
Answer:
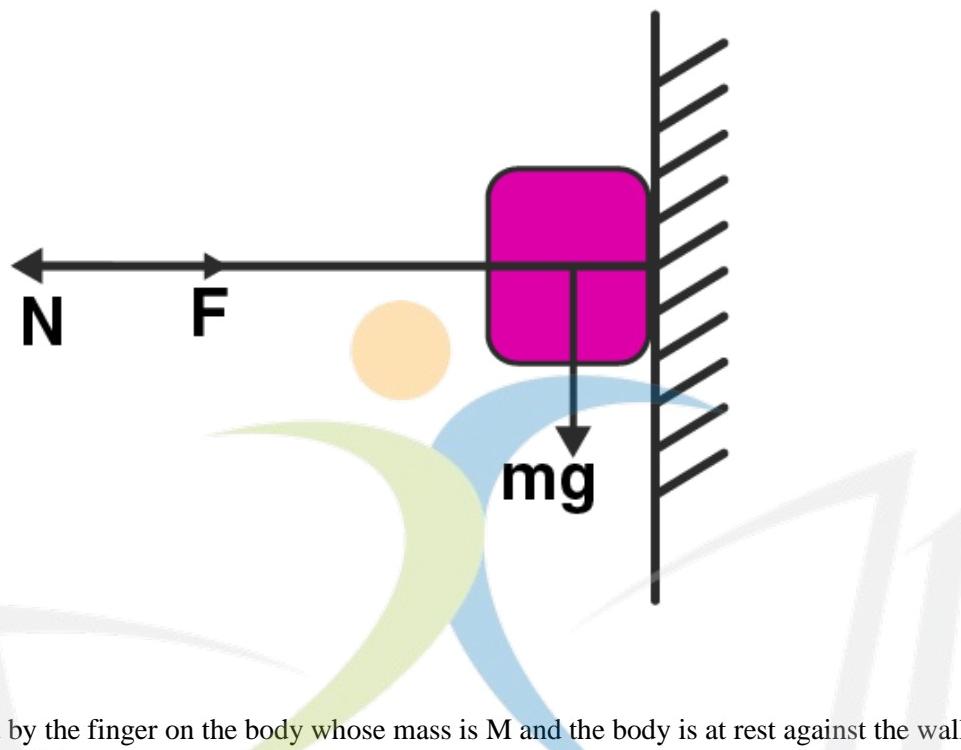
F is the force applied by the finger on the body whose mass is M and the body is at rest against the wall.
Using the balanced condition,
F = N
f = Mg
μF = Mg
F = Mg/μ is the minimum force that is required to hold the block against the wall at rest.

5.31. A 100 kg gun fires a ball of 1 kg horizontally from a cliff of height 500 m. It falls on the ground at a distance of 400 m from the bottom of the cliff. Find the recoil velocity of the gun.
**Answer:**
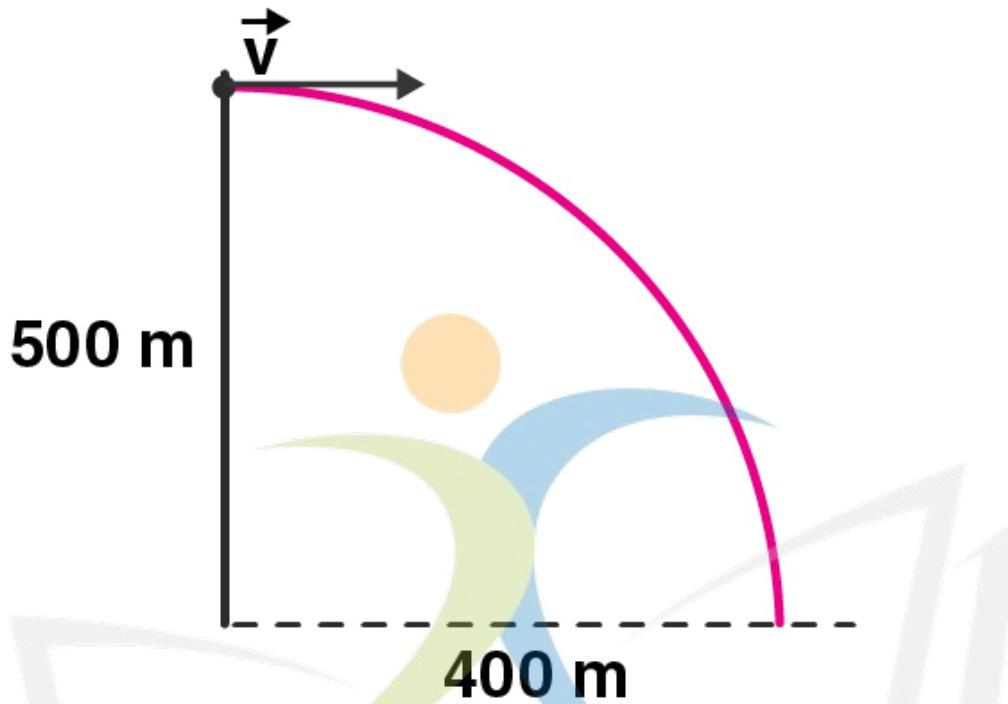
The horizontal speed of the ball is = u m/s

The vertical component is = 0

Considering the motion of the ball vertically downward

u = 0

s = h = 500 m

g = 10 s/m^2

s = ut + 1/2 at^2

Substituting the values, we get

t^2 = 100

t = 10 sec

Horizontal range = 10u

Which means v = 40 m/s

Using conservation of momentum, we can calculate the recoil velocity of the gun as = -40/100 m/s = -0.4 m/s which is the opposite side of the speed of the ball.

5.32. Figure shows (x,t) (y,t) diagram of a particle moving in 2-dimension. If the particle has a mass of 500 g, find the force acting on the particle.
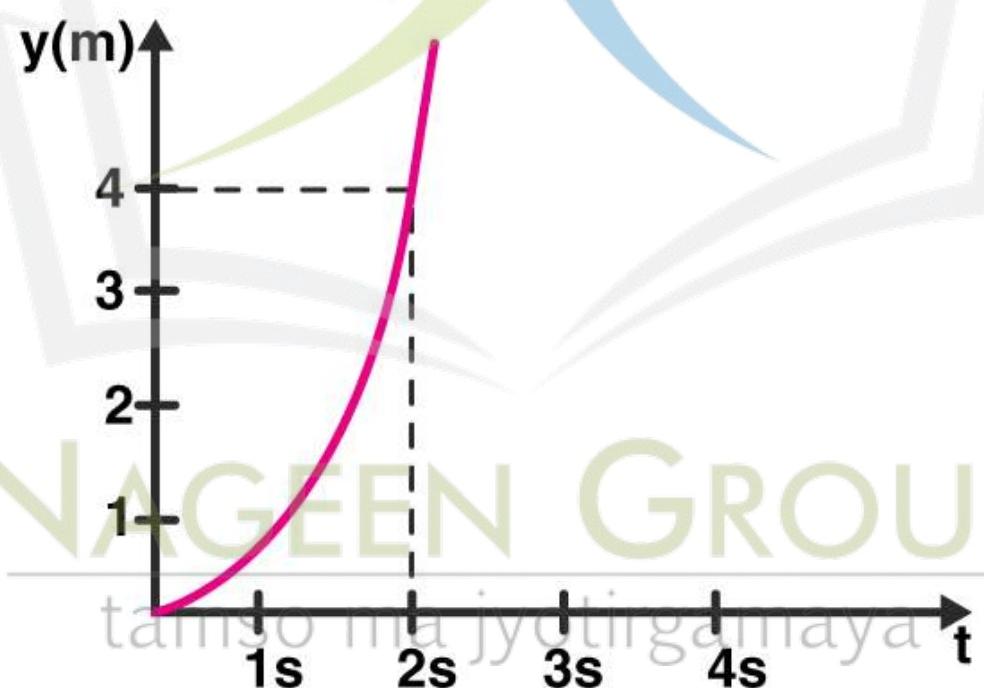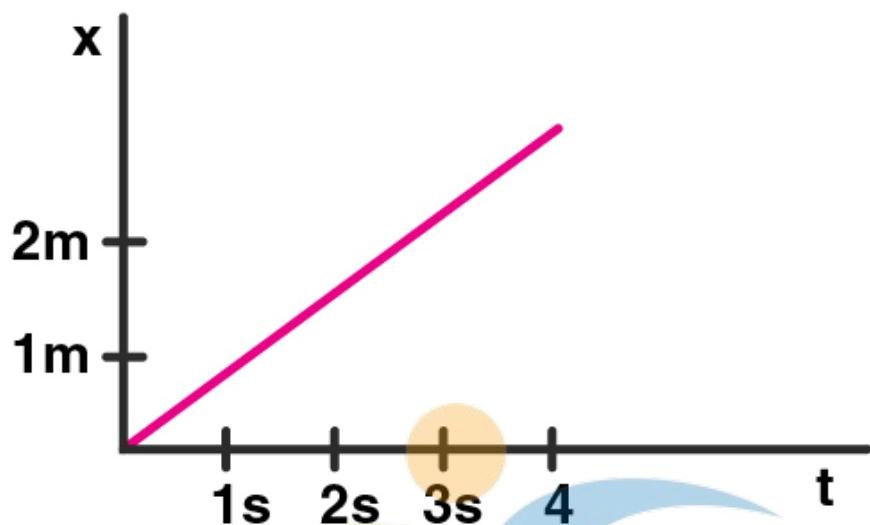
Answer:
For graph a)
$v_x = dx/dt = 2/2 = 1$ m/s
$a_x = d^2x/dt^2 = dv_x/dt = 0$

For graph b)

$y = t^2$

$v_y = dy/dt = 2t$

$a_y = dv_y/dt = 2$

Therefore, $F_y = ma_y$

$m = 500$ g $= 0.5$ kg

$F_y = (0.5)(2) = 1$ N towards y-axis

$F_x = (0.5)(0) = 0$ N

Therefore,

$$F = \sqrt{F_x^2 + F_y^2} = \sqrt{0^2 + 1^2} = \sqrt{1}$$

Therefore, $F = 1$ N towards y-axis.

5.33. A person in an elevator accelerating upwards with an acceleration of 2 m/s², tosses a coin vertically upwards with a speed of 20 m/s. After how much time will the coin fall back into his hand?

Answer:

The upward acceleration of an elevator, $a = 2$ m/s²

Acceleration due to gravity, $g = 10$ m/s²

Therefore, the net effective acceleration, $a' = (a + g) = 12$ m/s²

Considering the effective motion of the coin,

$v = 0$

t = time taken by the coin to achieve maximum height

$u = 20$ m/s

$a' = 12$ m/s²

Therefore, $v = u + at$

Where, $t = 5/3$ sec after substituting the values in the above equation.

Therefore, total time taken by the coin to return after achieving maximum height is 3(1/3) sec.

Long Answer

5.34. There are three forces F₁, F₂, and F₃ acting on a body, all acting on a point P on the body. The body is found to move with uniform speed.

a) show that the forces are coplanar

b) show that the torque acting on the body about any point due to these three forces is zero

Answer:

a) Acceleration of the body is zero as the three forces F_1, F_2, and F_3 on a point on a body has a resultant force equal to zero. The direction of forces F_1 and F_2 are in the plane of the paper and in their sum is in the opposite direction in the same plane. Also, F_3 is in the same plane. Therefore, all the three forces are coplanar.

b) The resultant of forces F_1, F_2, and F_3 are zero and the torque is also equal to zero. That is, the resultant force is given as:

$F = F_1 + F_2 + F_3 = 0$.

Therefore, it can be said that at any point the torque acting will be zero.

5.35. When a body slides down from rest along a smooth inclined plane making an angle of 45° with the horizontal, it takes time T. When the same body slides down from rest along a rough inclined plane making

the same angle and through the same distance, it is seen to take time pT, where p is some number greater than 1. Calculate the coefficient of friction between the body and the rough plane.

Answer:
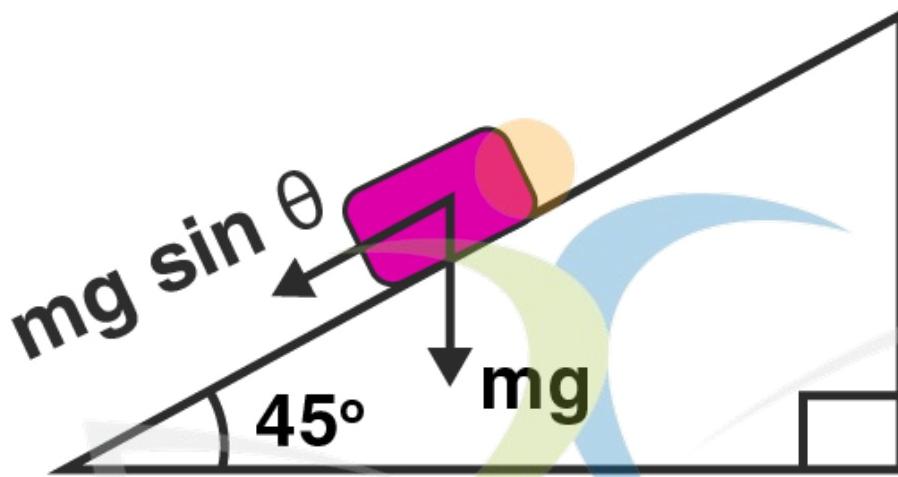
The inclined plane angle is 45° such that

$u = 0$

$s = s$

$t = T$

$a = g \sin 45° = g/\sqrt{2}$

$s = ut + 1/2 \, at^2$

$s = gT^2/2\sqrt{2}$

u = 0

s = gT²/2√2 → $s = gT^2/2\sqrt{2}$

ma = mg sin 45° – f
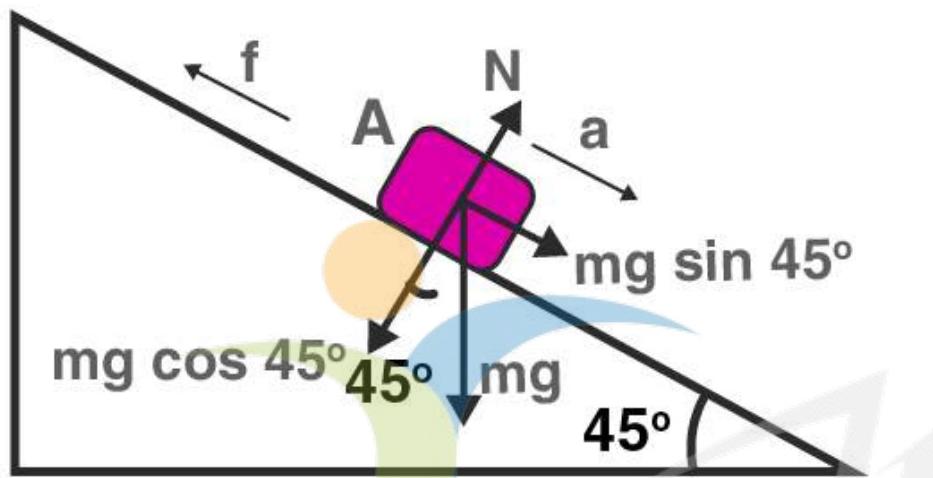
a = mg (1/√2 - μ/√2) → $a = mg(1/\sqrt{2} - \mu/\sqrt{2})$

Substituting the values, we get

μ = (1-1/p²) → $\mu = (1 - 1/p^2)$

5.36. Below figures show (v_x, t) and (v_y, t) diagrams for a body of unit mass. Find the force as a function of time.

(a)   (b)
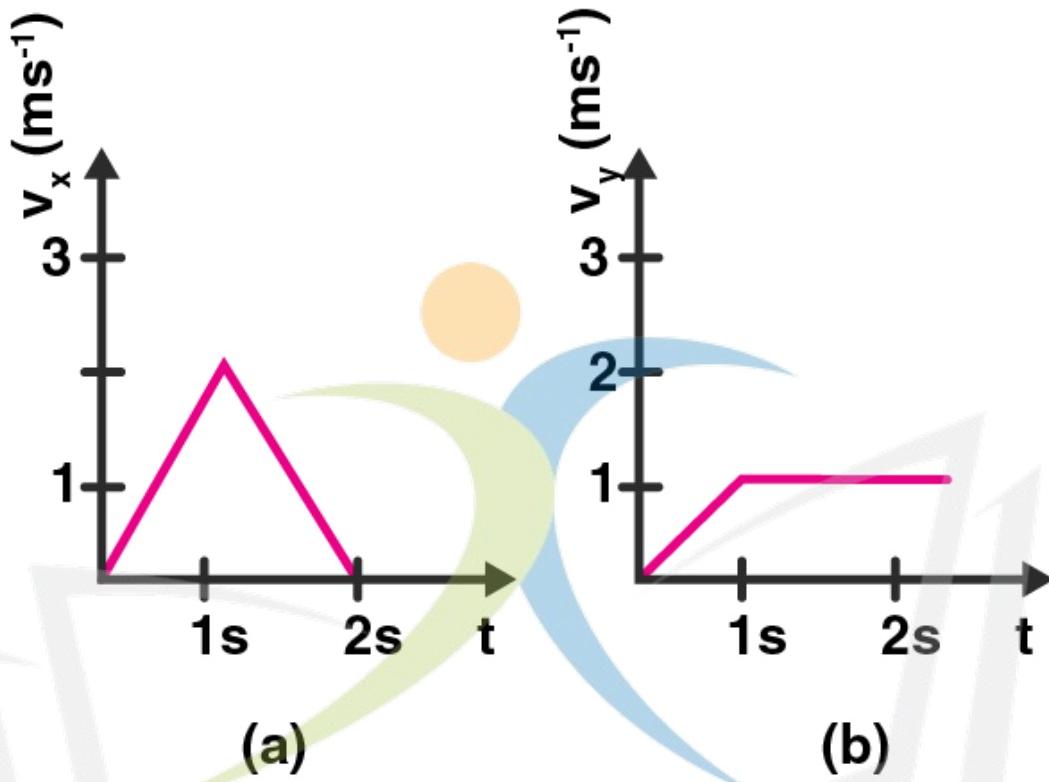
Answer:
For graph a)
$v_x = 2t$ for $0 < t < 1s$
$a_x = 2/1$ for $0 < t < 1s$
$v_x = 2(2-t)$ for $1 < t < 2s$
$a_x = -2/1 = -2$ for $1 < t < 2s$
Therefore, $F_x = ma$
Where m = 1
$F_x = -2$ for $1 < t < 2s$

For graph b)
$a_y = 1/1$ m/s^2 $0 < t < 1$
$F_y = ma = 1$ for $0 < t < 1$
$a_y = 0$ for $1 < t$
$F_y = 0$ for $1 < t < 2s$

The resultant force is given as:

$$\overrightarrow{F} = -2\hat{i} \ for \ 1 < t < 2s$$

5.37. A racing car travels on a track ABCDEFA. ABC is a circular arc of radius 2 R. CD and FA are straight paths of length R and DEF is a circular arc of radius R = 100 m. The coefficient of friction on the

road is μ = 0.1. The maximum speed of the car is 50 m/s. Find the minimum time for completing one round.
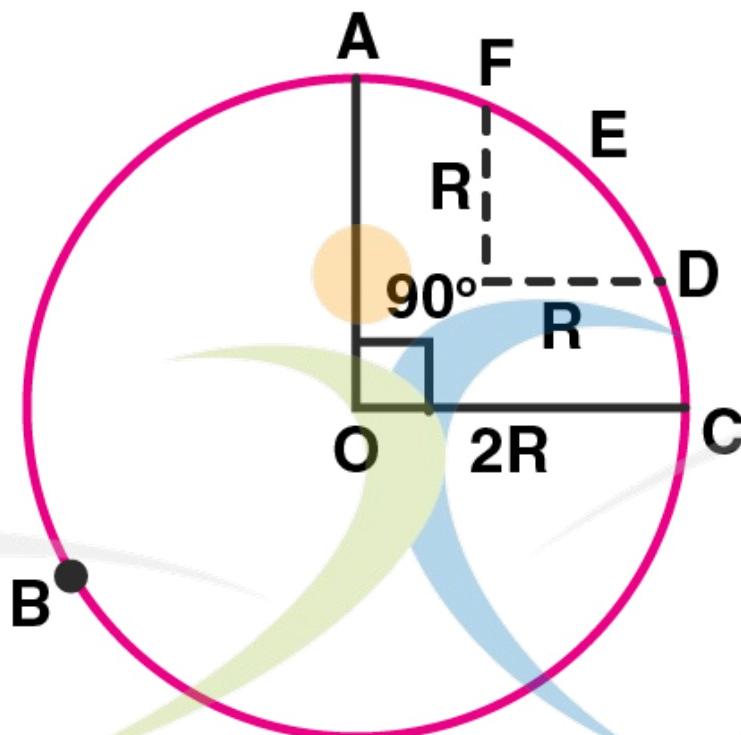
Answer:
Time taken from A to B to C
S1 = length pf path = 3/4 2π(2R) = 300π m
V1 = maximum speed of the car along the circular path
= √πrg = √(0.1)(2R)(g)
= 14.14 m/s
T1 = S1/V1 = 66.62 sec

Time taken from C to D and F to A
V2 is the maximum speed = 50 m/s
T2 = S2/V2 = 4 sec

Time taken from D to E to F
S3 = 1/4 2 πR = 50 π
V3 = √μrg = √(0.1)(100)(10) = 10 m/s
T3 = S3/V3 = 15.70 sec

Therefore, total time taken by the car = T1 + T2 + T3 = 86.32 sec

$$r(t) = \hat{i}Acos\omega t + \hat{j}Bsin\omega t$$

5.38. The displacement vector of a particle of mass m is given by

a) show that the trajectory is an ellipse

b) show that F = -mω²r

Answer:

a)

$$r(t) = \hat{i}A\cos\omega t + \hat{j}B\sin\omega t$$

x = A cos ωt

y = B sin ωt

x/A = cos ωt

y/B = sin ωt

Squaring both the equations and adding them,

$x^2/A^2 + y^2/B^2 = \cos^2 \omega t + \sin^2 \omega t$

$x^2/A^2 + y^2/B^2 = 1$

The above equation is of an ellipse and so the trajectory is an ellipse.

b) x = A cos ωt

$v_x = dx/dt = -A\omega \sin \omega t$

$a_x = dv_z/dt = -A\omega^2 \cos \omega t$

y = B sin ωt

$v_y = dy/dt = B\omega \cos \omega t$

$a_y = dv_y/dt = -B\omega^2 \sin \omega t$

$$a = a_x\hat{i} + a_y\hat{j}$$

Solving the above, we get

$a = -\omega^2 rt$.

5.39. A cricket bowler releases the ball in two different ways

a) giving it only horizontal velocity and

b) giving it horizontal velocity and a small downward velocity.

The speed v_s at the time of release is the same. Both are released at a height H from the ground. Which one will have greater speed when the ball hits the ground? Neglect air resistance.

Answer:

a)

$$\frac{1}{2}v_z^2 = gH \Rightarrow v_z = \sqrt{2gH}$$

Speed at ground is given as:

$$\sqrt{v_s^2 + v_z^2} = \sqrt{v_s^2 + 2gH}$$

b)

$$\frac{1}{2}mv_s^2 + mgH$$

is the total energy of the ball when it hits the ground.

Therefore, a) and b) have the same speed.

5.40. There are four forces acting at a point P produced by strings as shown in the figure, which is at rest. Find the forces F1 and F2.
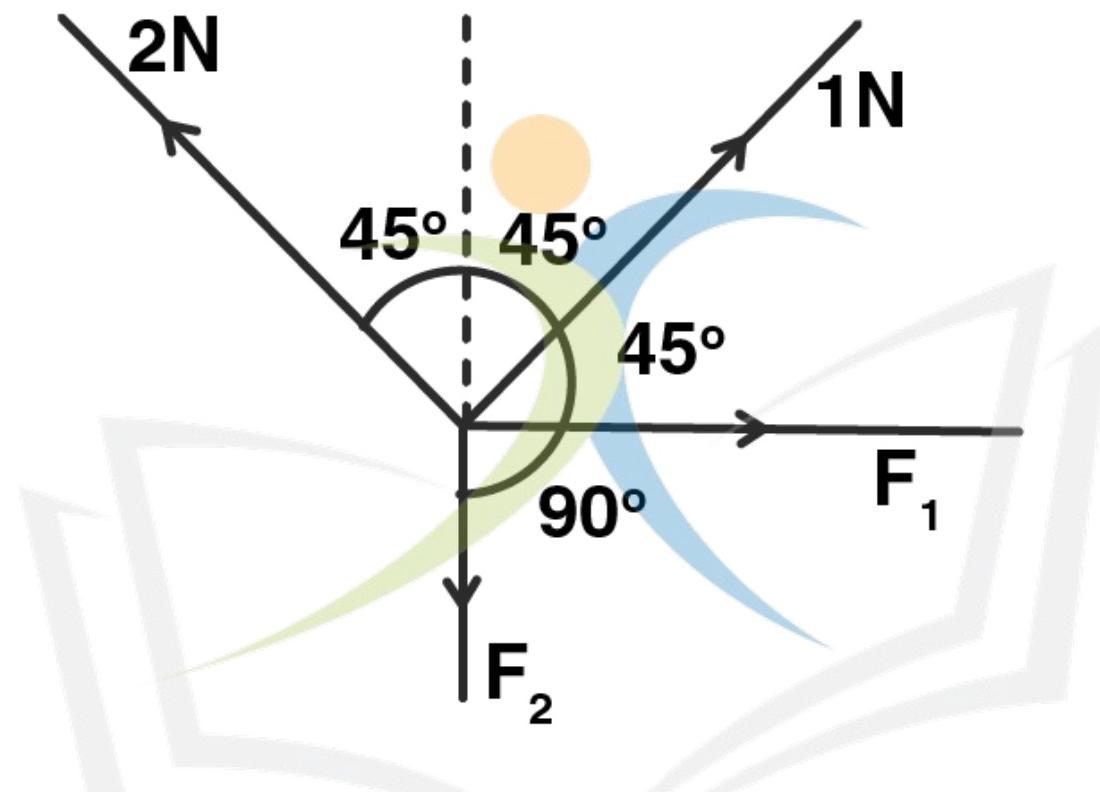
Answer:
The resultant forces on the point are zero as the point is at rest with a = 0
Therefore, the net components along X and Y axis will be zero.
Resolving all the forces along X-axis is
$F_x = 0$
$F1 + 1 \cos 45° - 2 \cos 45° = 0$
$F1 - 1 \cos 45° = 0$
$F1 = \cos 45° = 0.707$ N

Resolving all the forces along Y-axis is
$F_y = 0$
$-F2 + 1 \cos 45° + 2 \cos 45° = 0$
$-F2 = -3 \cos 45°$
$F2 = 2.121$N

5.41. A rectangular box lies on a rough inclined surface. The coefficient of friction between the surface and the box is μ. Let the mass of the box be m.
a) at what angle of inclination θ of the plane to the horizontal will the box just start to slide down the plane?
b) what is the force acting on the box down the plane, if the angle of inclination of the plane is increased to

a > θ

c) what is the force needed to be applied upwards along the plane to make the box either remain stationary or just move up with uniform speed?

d) what is the force needed to be applied upwards along the plane to make the box move up the plane with acceleration a.

Answer:
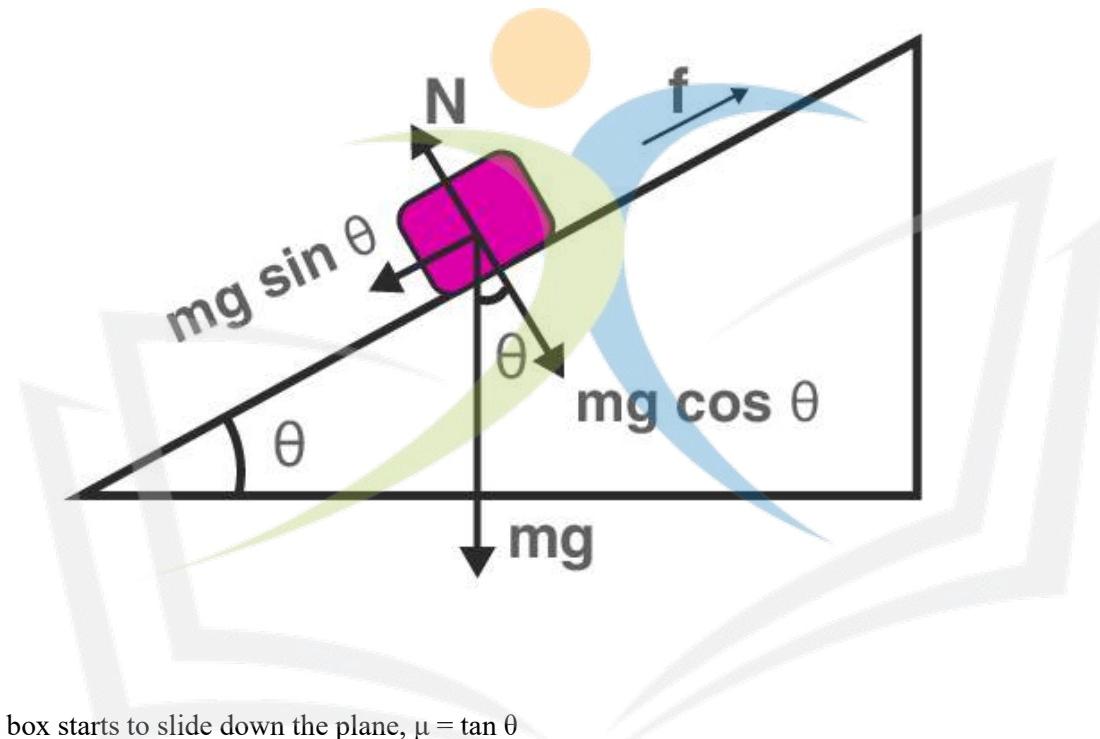
a) As the box starts to slide down the plane, $\mu = \tan\theta$

$\theta = \tan^{-1}(\mu)$

b) If a > θ, the angle of inclination will be the angle of repose and the net force acting will be in the downward

$F1 = mg \sin a - f = mg \sin a - \mu N$

$= mg \sin a - \mu \, mg \cos a$

$F1 = mg (\sin a - \mu \cos a)$

c) F2 is the force which is required to keep the box stationary and to move with uniform velocity

$F2 - mg \sin a - f = ma$

Or

$F2 - mg \sin a - \mu N = 0$

$F2 = mg \sin a - \mu N = 0$

$F2 = mg (\sin a - \mu \cos a)$

d) F3 is the force that is required to move the box upward with a as acceleration

$F3 - mg \sin a - \mu \, mg \cos a = ma$

$F3 = mg (\sin a + \mu \cos a) + ma$

5.42. A helicopter of mass 2000 kg rises with a vertical acceleration of 15 m/s2. The total mass of the crew

and passengers is 500 kg. Give the magnitude and direction of the
a) force on the floor of the helicopter by the crew and passengers
b) action of the rotor of the helicopter on the surrounding air
c) force on the helicopter due to the surrounding air

Answer:

Given,

Mass of helicopter, M = 2000 kg

Mass of the crew and passenger, m = 500 kg

Acceleration of helicopter with crew and passengers = 15 m/s2

a) Force on the floor of the helicopter by the crew and passenger = m(g + a) = 500(10 + 15)

F1 = (500)(25) = 12500 N

b) Action of the rotor of the helicopter on the surrounding air is force F2.

The acceleration due to Newton's third law is when acceleration is 15 m/s = (M + m)(g + a)

= (2000 + 500) (g + a)

= 2500(10 + 15)

= 62500 N

c) Force on the helicopter due to the surrounding air is F3.

F3 = Action force = - 62500 N or + 62500 N
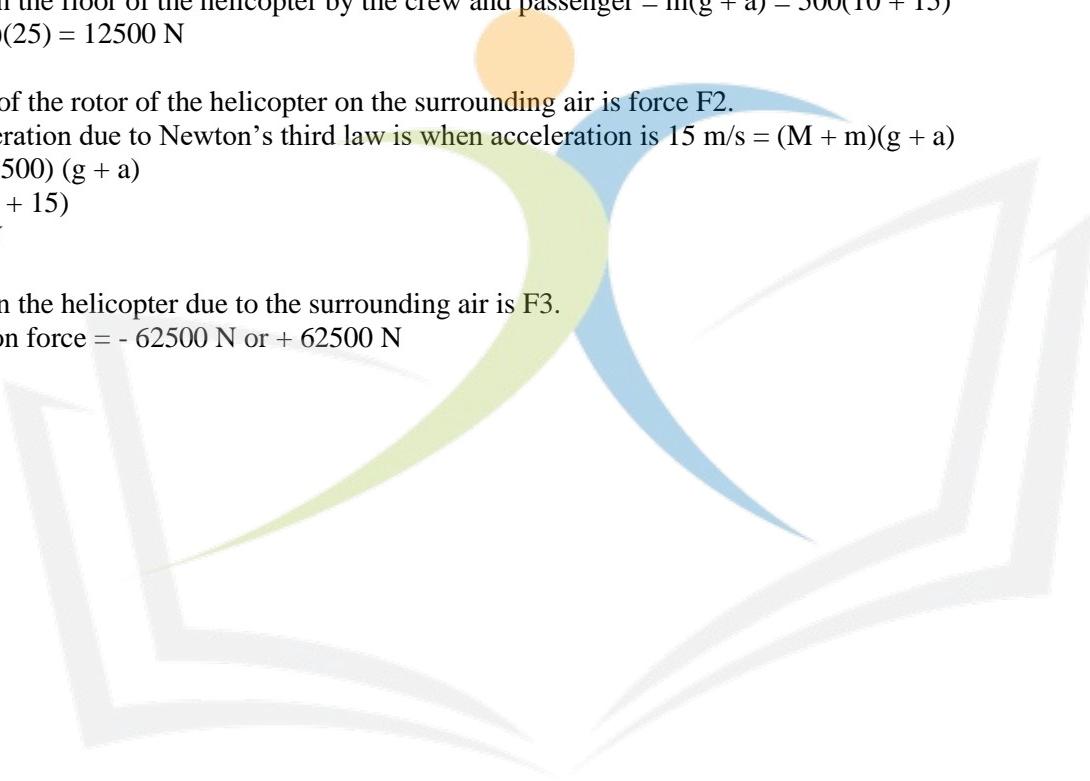
CLICK TO DOWNLOAD NCERT EXEMPLAR SOLUTIONS

CLASS 11: PHYSICS (ALL CHAPTERS)

SCHOOL OF EDUCATORS

SOE

Learn | Unlearn | Relearn

JOIN OUR WHATSAPP GROUPS

FOR FREE EDUCATIONAL RESOURCES

JOIN SCHOOL OF EDUCATORS WHATSAPP GROUPS FOR FREE EDUCATIONAL RESOURCES

We are thrilled to introduce the School of Educators WhatsApp Group, a platform designed exclusively for educators to enhance your teaching & Learning experience and learning outcomes. Here are some of the key benefits you can expect from joining our group:

BENEFITS OF SOE WHATSAPP GROUPS

- **Abundance of Content:** Members gain access to an extensive repository of educational materials tailored to their class level. This includes various formats such as PDFs, Word files, PowerPoint presentations, lesson plans, worksheets, practical tips, viva questions, reference books, smart content, curriculum details, syllabus, marking schemes, exam patterns, and blueprints. This rich assortment of resources enhances teaching and learning experiences.

- **Immediate Doubt Resolution:** The group facilitates quick clarification of doubts. Members can seek assistance by sending messages, and experts promptly respond to queries. This real-time interaction fosters a supportive learning environment where educators and students can exchange knowledge and address concerns effectively.

- **Access to Previous Years' Question Papers and Topper Answers:** The group provides access to previous years' question papers (PYQ) and exemplary answer scripts of toppers. This resource is invaluable for exam preparation, allowing individuals to familiarize themselves with the exam format, gain insights into scoring techniques, and enhance their performance in assessments.

- **Free and Unlimited Resources:** Members enjoy the benefit of accessing an array of educational resources without any cost restrictions. Whether its study materials, teaching aids, or assessment tools, the group offers an abundance of resources tailored to individual needs. This accessibility ensures that educators and students have ample support in their academic endeavors without financial constraints.

- **Instant Access to Educational Content:** SOE WhatsApp groups are a platform where teachers can access a wide range of educational content instantly. This includes study materials, notes, sample papers, reference materials, and relevant links shared by group members and moderators.

- **Timely Updates and Reminders:** SOE WhatsApp groups serve as a source of timely updates and reminders about important dates, exam schedules, syllabus changes, and academic events. Teachers can stay informed and well-prepared for upcoming assessments and activities.

- **Interactive Learning Environment:** Teachers can engage in discussions, ask questions, and seek clarifications within the group, creating an interactive learning environment. This fosters collaboration, peer learning, and knowledge sharing among group members, enhancing understanding and retention of concepts.

- **Access to Expert Guidance:** SOE WhatsApp groups are moderated by subject matter experts, teachers, or experienced educators can benefit from their guidance, expertise, and insights on various academic topics, exam strategies, and study techniques.

Join the School of Educators WhatsApp Group today and unlock a world of resources, support, and collaboration to take your teaching to new heights. To join, simply click on the group links provided below or send a message to +91-95208-77777 expressing your interest.

Together, let's empower ourselves & Our Students and inspire the next generation of learners.

Best Regards,
Team
School of Educators

Join School of Educators WhatsApp Groups

You will get Pre- Board Papers PDF, Word file, PPT, Lesson Plan, Worksheet, practical tips and Viva questions, reference books, smart content, curriculum, syllabus, marking scheme, toppers answer scripts, revised exam pattern, revised syllabus, Blue Print etc. here . Join Your Subject / Class WhatsApp Group.

Kindergarten to Class XII (For Teachers Only)

Click Here to Join — **Class 1**

Click Here to Join — **Class 2**

Click Here to Join — **Class 3**

Click Here to Join — **Class 4**

Click Here to Join — **Class 5**

Click Here to Join — **Class 6**

Click Here to Join — **Class 7**

Click Here to Join — **Class 8**

Click Here to Join — **Class 9**

Click Here to Join — **Class 10**

Click Here to Join — **Class 11 (Science)**

Click Here to Join — **Class 11 (Humanities)**

Click Here to Join — **Class 11 (Commerce)**

Click Here to Join — **Class 12 (Science)**

Click Here to Join — **Class 12 (Humanities)**

Click Here to Join — **Class 12 (Commerce)**

Click Here to Join — **Kindergarten**

Subject Wise Secondary and Senior Secondary Groups (IX & X For Teachers Only)

Secondary Groups (IX & X)

Click Here to Join **SST**

Click Here to Join **Mathematics**

Click Here to Join **Science**

Click Here to Join **English**

Click Here to Join **Hindi-A**

Click Here to Join **IT Code-402**

Click Here to Join **Hindi-B**

Click Here to Join **Artificial Intelligence**

Senior Secondary Groups (XI & XII For Teachers Only)

Click Here to Join **Physics**

Click Here to Join **Chemistry**

Click Here to Join **English**

Click Here to Join **Mathematics**

Click Here to Join **Biology**

Click Here to Join **Accountancy**

Click Here to Join **Economics**

Click Here to Join **BST**

Click Here to Join **History**

Geography — Click Here to Join

Sociology — Click Here to Join

Hindi Elective — Click Here to Join

Hindi Core — Click Here to Join

Home Science — Click Here to Join

Sanskrit — Click Here to Join

Psychology — Click Here to Join

Political Science — Click Here to Join

Painting — Click Here to Join

Vocal Music — Click Here to Join

Comp. Science — Click Here to Join

IP — Click Here to Join

Physical Education — Click Here to Join

APP. Mathematics — Click Here to Join

Legal Studies — Click Here to Join
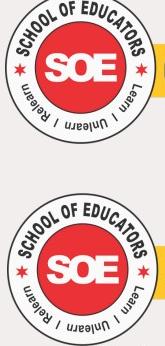
Entrepreneurship — Click Here to Join

French — Click Here to Join

IT — Click Here to Join

Artificial Intelligence — Click Here to Join

Other Important Groups (For Teachers & Principal's)

Principal's Group — Click Here to Join

Teachers Jobs — Click Here to Join

IIT/NEET — Click Here to Join

Join School of Educators WhatsApp Groups

You will get Pre- Board Papers PDF, Word file, PPT, Lesson Plan, Worksheet, practical tips and Viva questions, reference books, smart content, curriculum, syllabus, marking scheme, toppers answer scripts, revised exam pattern, revised syllabus, Blue Print etc. here . Join Your Subject / Class WhatsApp Group.

Kindergarten to Class XII (For Students Only)

SOE Click Here to Join
Class 1

SOE Click Here to Join
Class 2

SOE Click Here to Join
Class 3

SOE Click Here to Join
Class 4

SOE Click Here to Join
Class 5

SOE Click Here to Join
Class 6

SOE Click Here to Join
Class 7

SOE Click Here to Join
Class 8

SOE Click Here to Join
Class 9

SOE Click Here to Join
Class 10

SOE Click Here to Join
Class 11 (Science)

SOE Click Here to Join
Class 11 (Humanities)

SOE Click Here to Join
Class 11 (Commerce)

SOE Click Here to Join
Class 12 (Science)

SOE Click Here to Join
Class 12 (Humanities)

SOE Click Here to Join
Class 12 (Commerce)

SOE Click Here to Join
Artificial Intelligence (VI TO VIII)

Subject Wise Secondary and Senior Secondary Groups (IX & X For Students Only)

Secondary Groups (IX & X)

Click Here to Join **SST**	**Click Here to Join** **Mathematics**	**Click Here to Join** **Science**
Click Here to Join **English**	**Click Here to Join** **Hindi**	**Click Here to Join** **IT Code**
	Click Here to Join **Artificial Intelligence**	

Senior Secondary Groups (XI & XII For Students Only)

Click Here to Join **Physics**	**Click Here to Join** **Chemistry**	**Click Here to Join** **English**
Click Here to Join **Mathematics**	**Click Here to Join** **Biology**	**Click Here to Join** **Accountancy**
Click Here to Join **Economics**	**Click Here to Join** **BST**	**Click Here to Join** **History**

Geography	**Sociology**	**Hindi Elective**
Click Here to Join	Click Here to Join	Click Here to Join
Hindi Core	**Home Science**	**Sanskrit**
Click Here to Join	Click Here to Join	Click Here to Join
Psychology	**Political Science**	**Painting**
Click Here to Join	Click Here to Join	Click Here to Join
Music	**Comp. Science**	**IP**
Click Here to Join	Click Here to Join	Click Here to Join
Physical Education	**APP. Mathematics**	**Legal Studies**
Click Here to Join	Click Here to Join	Click Here to Join
Entrepreneurship	**French**	**IT**
Click Here to Join	Click Here to Join	Click Here to Join
AI	**IIT/NEET**	**CUET**

Groups Rules & Regulations:

To maximize the benefits of these WhatsApp groups, follow these guidelines:

1. Share your valuable resources with the group.
2. Help your fellow educators by answering their queries.
3. Watch and engage with shared videos in the group.
4. Distribute WhatsApp group resources among your students.
5. Encourage your colleagues to join these groups.

Additional notes:
1. Avoid posting messages between 9 PM and 7 AM.
2. After sharing resources with students, consider deleting outdated data if necessary.
3. It's a NO Nuisance groups, single nuisance and you will be removed.
   - No introductions.
   - No greetings or wish messages.
   - No personal chats or messages.
   - No spam. Or voice calls
   - Share and seek learning resources only.

Please only share and request learning resources. For assistance, contact the helpline via WhatsApp: +91-95208-77777.

Join Premium WhatsApp Groups
Ultimate Educational Resources!!

Join our premium groups and just Rs. 1000 and gain access to all our exclusive materials for the entire academic year. Whether you're a student in Class IX, X, XI, or XII, or a teacher for these grades, Artham Resources provides the ultimate tools to enhance learning. Pay now to delve into a world of premium educational content!

Click here for more details

Click Here to Join

Class 9

Click Here to Join

Class 10

Click Here to Join

Class 11

Click Here to Join

Class 12

📢 Don't Miss Out! Elevate your academic journey with top-notch study materials and secure your path to top scores! Revolutionize your study routine and reach your academic goals with our comprehensive resources. Join now and set yourself up for success! 📚🌟

Best Wishes,

Team
School of Educators & Artham Resources

SKILL MODULES BEING OFFERED IN MIDDLE SCHOOL

Artificial Intelligence

Beauty & Wellness

Design Thinking & Innovation

Financial Literacy

Handicrafts

Information Technology

Marketing/Commercial Application
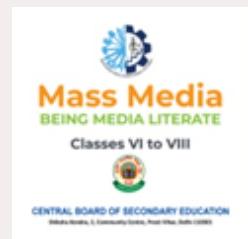
Mass Media - Being Media Literate
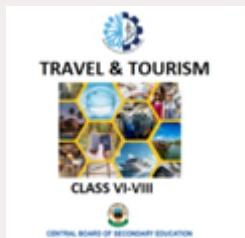
Travel & Tourism

Coding
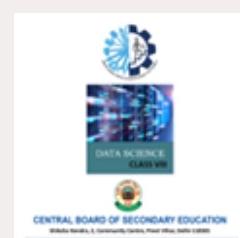
Data Science (Class VIII only)

Augmented Reality / Virtual Reality

Digital Citizenship
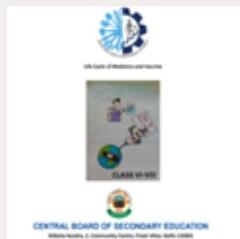
Life Cycle of Medicine & Vaccine
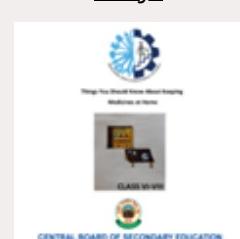
Things you should know about keeping Medicines at home
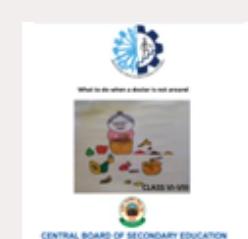
What to do when Doctor is not around
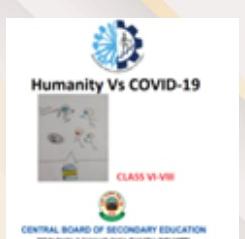
Humanity & Covid-19

Blue Pottery

Pottery
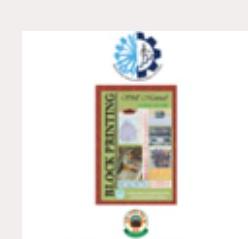
Block Printing

Food

Food Preservation

Baking

Herbal Heritage

Khadi

Mask Making

Mass Media

Making of a Graphic Novel

Kashmiri Embroidery

Embroidery

Rockets

Satellites

Application of Satellites
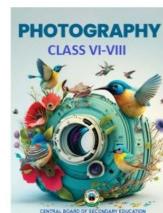
Photography

SKILL SUBJECTS AT SECONDARY LEVEL (CLASSES IX – X)

Retail

Information Technology

Security

Automotive

Introduction To Financial Markets

Introduction To Tourism

Beauty & Wellness

Agriculture

Food Production

Front Office Operations

Banking & Insurance

Marketing & Sales

Health Care

Apparel

Multi Media

Multi Skill Foundation Course

Artificial Intelligence

Physical Activity Trainer

Data Science

Electronics & Hardware (NEW)
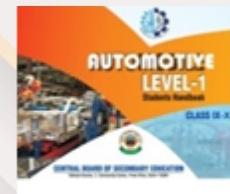
Foundation Skills For Sciences (Pharmaceutical & Biotechnology)(NEW)
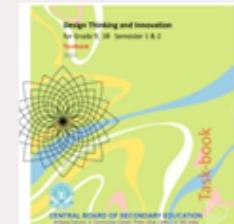
Design Thinking & Innovation (NEW)

SKILL SUBJECTS AT SR. SEC. LEVEL (CLASSES XI – XII)
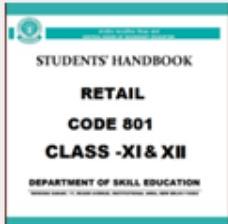
Retail
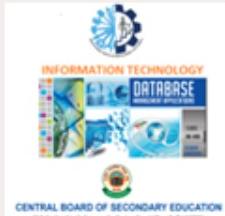
InformationTechnology

Web Application

Automotive

Financial Markets Management
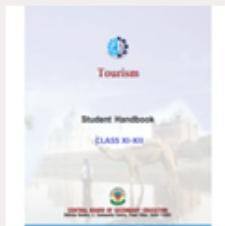
Tourism
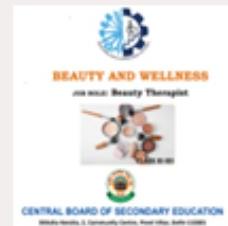
Beauty & Wellness
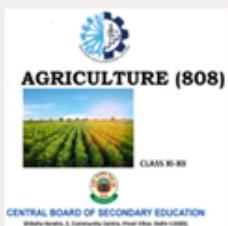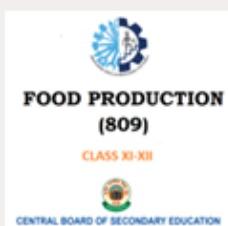
Agriculture

Food Production

Front Office Operations

Banking

Marketing

Health Care

Insurance

Horticulture
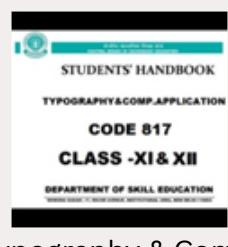
Typography & Comp. Application
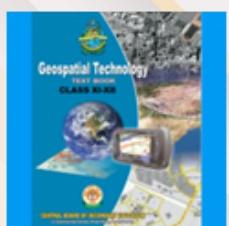
Geospatial Technology
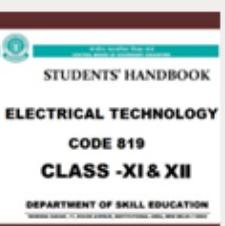
Electrical Technology

Electronic Technology
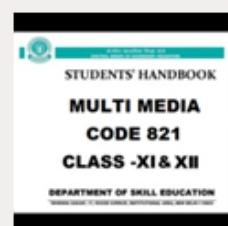
Multi-Media
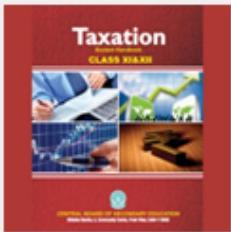
Taxation
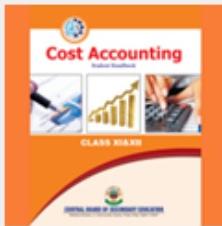
Cost Accounting
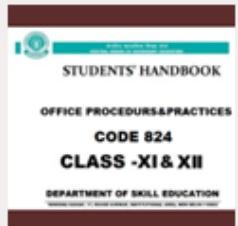
Office Procedures & Practices
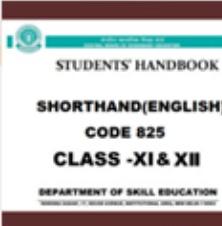
Shorthand (English)
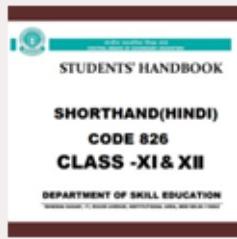
Shorthand (Hindi)
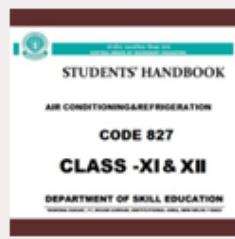
Air-Conditioning & Refrigeration
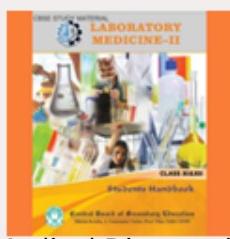
Medical Diagnostics

Textile Design
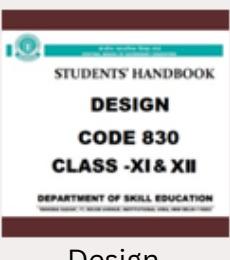
Design
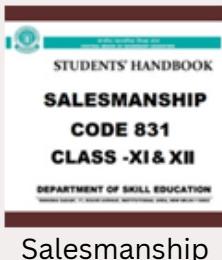
Salesmanship
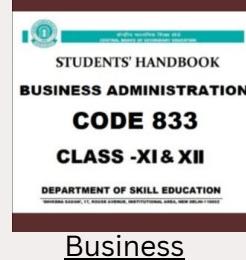
Business Administration
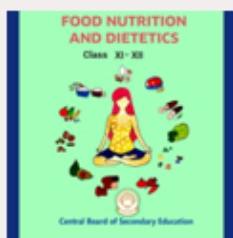
Food Nutrition & Dietetics
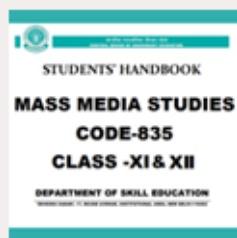
Mass Media Studies

Library & Information Science
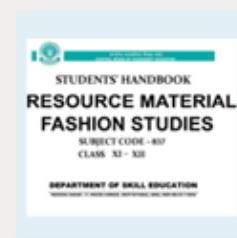
Fashion Studies
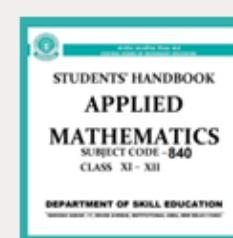
Applied Mathematics
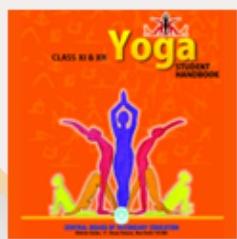
Yoga
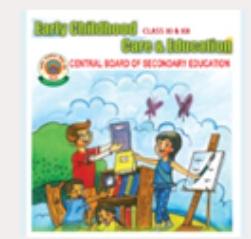
Early Childhood Care & Education
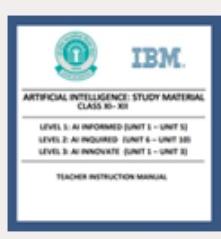
Artificial Intelligence
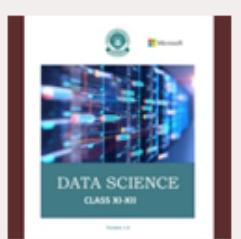
Data Science
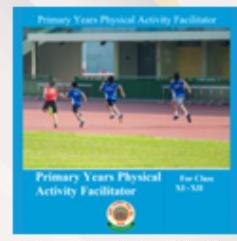
Physical Activity Trainer(new)
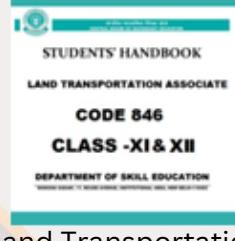
Land Transportation Associate (NEW)
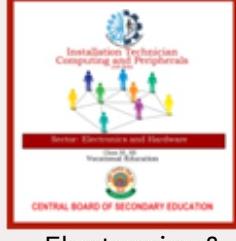
Electronics & Hardware (NEW)

Design Thinking & Innovation (NEW)